
**Petroleum and natural gas industries —
Drilling and production equipment — Drill-
through equipment**

*Industries du pétrole et du gaz naturel — Équipements de forage et de
production — Équipements à travers lesquels s'effectue le forage*

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Contents

	Page
Foreword.....	v
Introduction.....	vi
1 Scope	1
2 Normative references	4
3 Terms and definitions	5
4 Abbreviated terms	12
5 Design requirements	13
5.1 Size designation	13
5.2 Service conditions	13
5.3 Equipment-specific design requirements	14
5.4 Design methods	31
5.5 Design verification testing.....	33
5.6 Documentation.....	33
5.7 Tests for BOP and hydraulic connector operational characteristics.....	34
5.8 Design temperature verification testing for non-metallic sealing materials and moulded sealing assemblies.....	38
5.9 Operating manual requirements	39
6 Material requirements	40
6.1 General.....	40
6.2 Written specifications	40
6.3 Pressure-containing members	41
7 Welding requirements	47
7.1 General.....	47
7.2 Weldment design and configuration	47
7.3 Welding controls.....	51
7.4 Welding procedure and performance qualifications	52
7.5 Other requirements	53
8 Quality control requirements	56
8.1 General.....	56
8.2 Measuring and testing equipment	57
8.3 Quality control personnel qualifications.....	57
8.4 Quality control requirements for equipment and parts	57
8.5 Quality control requirements for specific equipment and parts	58
8.6 Requirements for quality control records.....	70
9 Marking requirements	72
9.1 General.....	72
9.2 Types of identification stamping	72
9.3 Specific codification requirements of equipment	72
9.4 Product description code (PDC)	75
10 Storing and shipping.....	77
10.1 Storing for periods greater than 30 days	77
10.2 Shipping.....	77
Annex A (normative) Qualification of heat-treating equipment	78
Annex B (normative) Requirements for repair and remanufacture	81
Annex C (informative) Operational characteristics test procedure	86

Annex D (informative) Procedure for design temperature verification testing	94
Annex E (informative) Purchasing guidelines	98
Annex F (informative) Failure reporting	100
Annex G (informative) Conversion of US Customary units to the SI system (metric)	101
Annex H (informative) List of national/regional standards applicable in context.....	105
Bibliography	106

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 13533 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum and natural gas industries*, Subcommittee SC 4, *Drilling and production equipment*.

Annexes A and B form a normative part of this International Standard. Annexes C, D, E, F, G and H are for information only.

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Introduction

This International Standard is based on API Specification 16A, second edition, 1 June 1998.

This International Standard is intended to provide for the availability of safe and functionally interchangeable drill-through equipment utilized in the petroleum and natural gas industry.

Users of this International Standard should be aware that further or differing requirements may be needed for individual applications. This International Standard is not intended to inhibit a vendor from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the vendor should identify any variations from this International Standard and provide details.

For the convenience of users of this International Standard, annex H provides a list of those normative International Standards cited in clause 2 with national or regional standards which have been found mutually applicable in the context of the requirements in the text. The user may optionally apply the national or regional standard in the context of the requirement for which the International Standard is cited.

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Petroleum and natural gas industries — Drilling and production equipment — Drill-through equipment

1 Scope

This International Standard specifies requirements for performance, design, materials, testing and inspection, welding, marking, handling, storing and shipping of drill-through equipment used for drilling for oil and gas. It also defines service conditions in terms of pressure, temperature and wellbore fluids for which the equipment will be designed.

This International Standard is applicable to and establishes requirements for the following specific equipment:

- a) ram blowout preventers;
- b) ram blocks, packers and top seals;
- c) annular blowout preventers;
- d) annular packing units;
- e) hydraulic connectors;
- f) drilling spools;
- g) adapters;
- h) loose connections;
- i) clamps.

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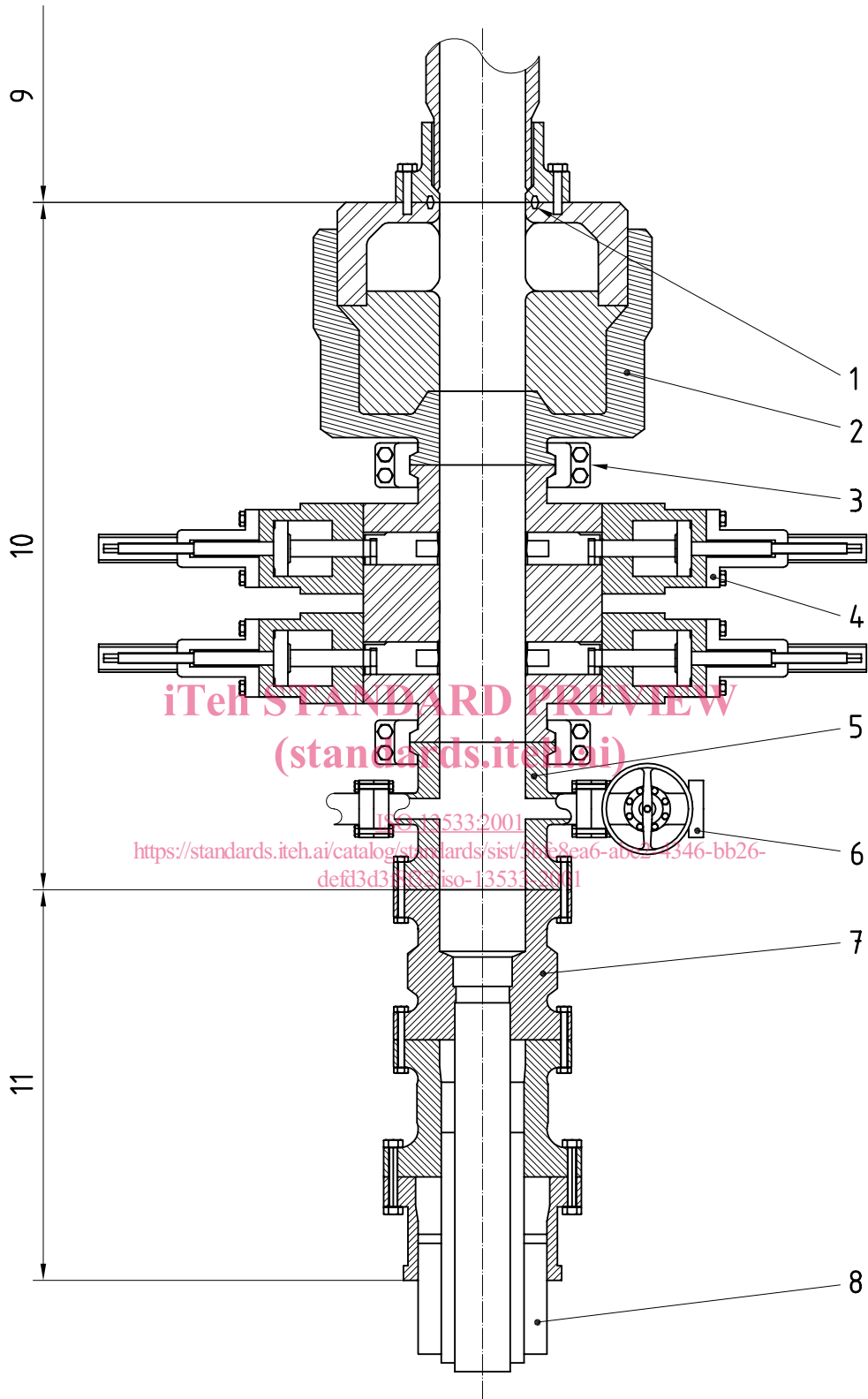
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Dimensional interchangeability is limited to end and outlet connections.

Typical equipment defined by this International Standard is shown in Figures 1 and 2; recommendations for failure reporting are outlined in annex F.

This International Standard does not apply to field use or field testing of drill-through equipment.



Key

- | | | | |
|---|------------------------|----|-----------------------------------|
| 1 | Ring gaskets ISO 10423 | 7 | Wellhead |
| 2 | Annular BOP | 8 | Casing |
| 3 | Clamp | 9 | End and outlet connections |
| 4 | Ram BOP | 10 | Drill-through equipment ISO 13533 |
| 5 | Drilling spool | 11 | Wellhead equipment ISO 10423 |
| 6 | Valve ISO 10423 | | |

Figure 1 — Typical surface drill-through equipment

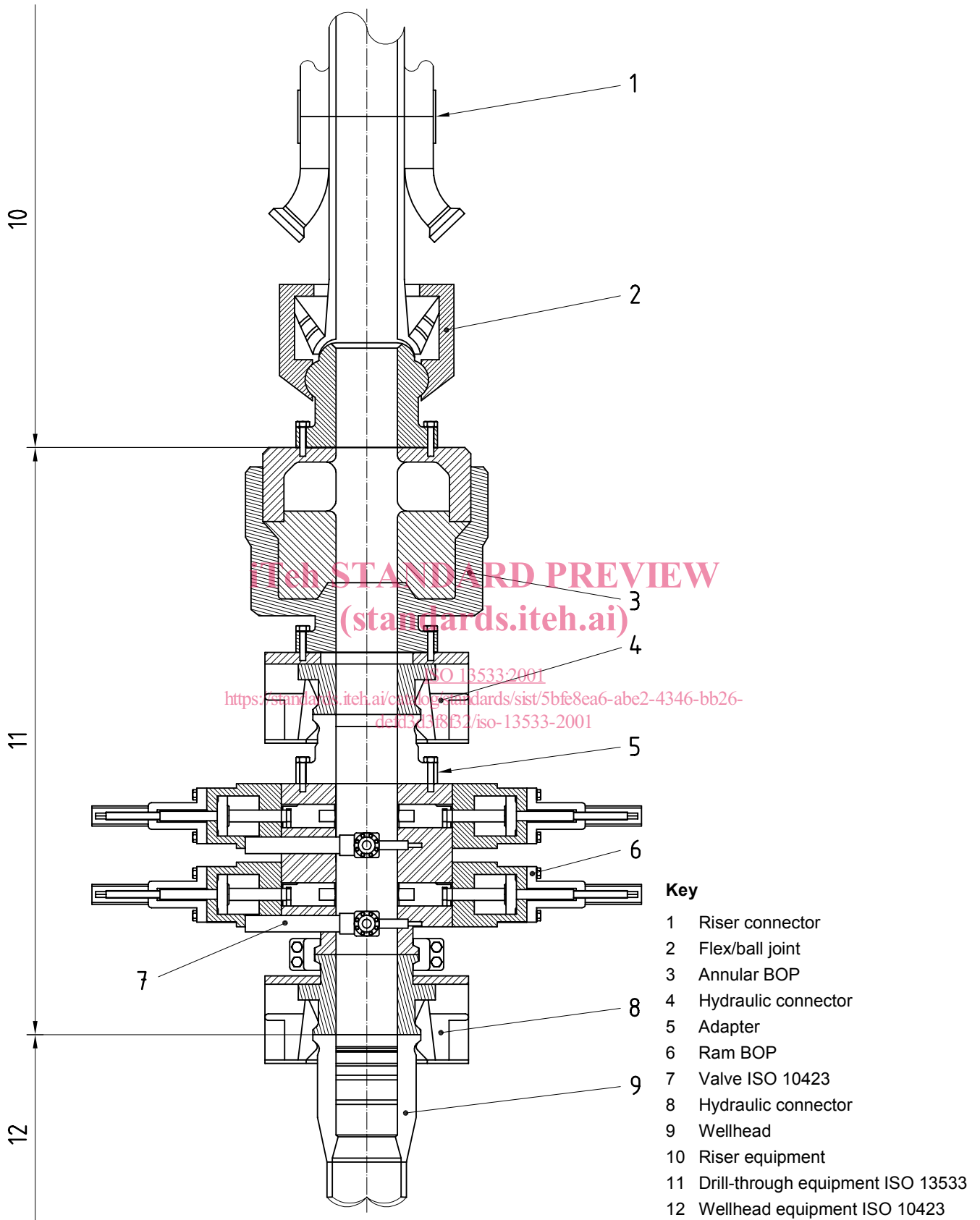


Figure 2 — Typical subsea drill-through equipment

2 Normative references

The following normative documents contain provisions, which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 2859-1:1989, *Sampling procedures for inspection by attributes — Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection*

ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6508-1, *Metallic materials — Rockwell hardness test — Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)*

ISO 6892, *Metallic materials — Tensile testing at ambient temperature*

ISO 10423:2001, *Petroleum and natural gas industries — Drilling and production equipment — Wellhead and christmas tree equipment*

ISO 11961:1996, *Petroleum and natural gas industries — Steel pipes for use as drill pipe — Specification*

ISO 13665, *Seamless and welded steel tubes for pressure purposes — Magnetic particle inspection of the tube body for the detection of surface imperfections*

API Bulletin 6AF, *Capabilities of API flanges under combinations of load*

ASME Boiler and Pressure Vessel Code Section V, Article 5, *UT Examination Methods for Materials and Fabrication*

ASME Boiler and Pressure Vessel Code Section VIII, Division 1, Appendix 4, *Rounded Indication Charts Acceptance Standard for Radiographically Determined Rounded Indications in Welds*

ASME Boiler and Pressure Vessel Code Section VIII, Division 2, Pressure Vessel — Alternate Rules, Appendix 4, *Design Based on Stress Analysis*

ASME Boiler and Pressure Vessel Code Section VIII, Division 2, Pressure Vessel — Alternate Rules, Appendix 6, *Experimental Stress Analysis*

ASME Boiler and Pressure Vessel Code Section IX, Articles I, II, III and IV

ASTM A 193:1999, *Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service*

ASTM A 320:1999, *Specification for Alloy Steel Bolting Materials for Low Temperature Service*

ASTM A 370:1997, *Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A 453:1999, *Specification for Bolting Materials, High Temperature, 50 to 120 ksi Yield Strength, with Expansion Coefficients Comparable to Austenitic Steels*

ASTM D 395:1998, *Standard Test Methods for Rubber Property — Compression Set*

ASTM D 412:1998, *Test Methods for Vulcanized Rubber, Thermoplastic Rubbers and Thermoplastic Elastomers*

ASTM D 471:1998, *Standard Test Method for Rubber Property — Effect of Liquids*

ASTM D 1414:1994, *Standard Test Methods for Rubber O-Rings*

ASTM D 1415:1994, *Standard Test Method for Rubber Property — International Hardness*

ASTM D 1418:1999, *Standard Practice for Rubber and Rubber Lattices — Nomenclature*

ASTM D 2240:1997, *Test Method for Rubber Property — Durometer Hardness*

ASTM E 94:1993, *Standard Guide for Radiographic Testing*

ASTM E 140:1999, *Hardness Conversion Tables for Metals*

ASTM E 165:1995, *Standard Test Method for Liquid Penetrant Examination*

ASTM E 569:1997, *Standard Practice for Acoustic Emission Monitoring of Structures During Controlled Simulation*

ASTM E 747:1997, *Standard Practice for Design, Manufacture, and Material Grouping Classification of Wire Image Quality Indicators (IQI) used for Radiography*

ASNT-SNT-TC-1A:1992, *Recommended Practice for Personnel Qualification and Certification in Nondestructive Testing*

NACE MR0175–2000, *Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment*

SAE AMS-H-6875A:1998, *Heat Treatment of Steel Raw Materials*

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3 Terms and definitions

For the purpose of this International Standard, the following terms and definitions apply.

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3.1

acceptance criteria

defined limits placed on characteristics of materials, products or service

3.2

adapter

pressure-containing piece of equipment having end connections of different nominal size designation and/or pressure rating

3.3

annular blowout preventer

blowout preventer that uses a shaped elastomeric sealing element to seal the space between the tubular and the wellbore or an open hole

3.4

blind connection

end or outlet connection with no centre bore, used to completely close off a connection

3.5

blind-shear ram

closing and sealing component in a ram blowout preventer that first shears the tubular in the wellbore and then seals off the bore or acts as a blind ram if there is no tubular in the wellbore

3.6

blind ram

closing and sealing component in a ram blowout preventer that seals the open wellbore

3.7

blowout preventer

BOP

equipment (or valve) installed at the wellhead to contain wellbore pressure either in the annular space between the casing and the tubulars or in an open hole during drilling, completion, testing or workover operations

3.8

body

any portion of equipment between end connections, with or without internal parts, which contains wellbore pressure

3.9

bolting

threaded fasteners used to join end or outlet connections

3.10

calibration

comparison and adjustment to a standard of known accuracy

3.11

cast, verb

pour molten metal into a mould to produce an object of desired shape

3.12

casting, noun

object at or near finished shape obtained by solidification of a substance in a mould

3.13

chemical analysis

determination of the chemical composition of material

3.14

clamp, noun

device with internal angled shoulders used to fasten mating hubs

3.15

clamping load

axial load applied to clamp hubs by the clamp due to bolt tightening

3.16

closure bolting

threaded fasteners used to assemble pressure-containing parts other than end and outlet connections

3.17

conformance

compliance with specified requirements in every detail

3.18

corrosion-resistant ring groove

ring groove lined with metal resistant to metal-loss corrosion

3.19

critical component

part having requirements specified in this International Standard

3.20

data acquisition system

system for storing and/or providing permanent copies of test information

EXAMPLES Strip chart recorders, circular chart recorders or computer systems.

3.21**date of manufacture**

date of the manufacturer's final acceptance of finished equipment

3.22**drilling spool**

pressure-containing piece of equipment having end connections, used below or between drill-through equipment

NOTE When outlet connections are provided, they shall be manufactured in accordance with this International Standard.

3.23**end connection**

flange (studded or open-face), hub connection or **other end connection** (3.47) used to join together equipment and integral to that equipment

3.24**equipment**

any single completed unit that can be used for its intended purpose without further processing or assembly

3.25**fabrication weld**

weld joining two or more parts

3.26**flange**

protruding rim, with holes to accept bolts and having a sealing mechanism, used to join pressure-containing equipment together by bolting to another flange

3.27**forge, verb**

plastically deform metal, usually hot, into desired shapes with compressive force, with open or closed dies

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3.28**forging, noun**

shaped metal part formed by the forging method

3.29**full-penetration weld**

weld that extends throughout the complete wall section of the parts joined

3.30**gasket-seating load**

that portion of the clamping load required to seat the gasket and bring the hub faces into contact

3.31**gasket-retaining load**

that portion of the clamping load required to offset the separating force the gasket exerts on the hubs when pressurized

3.32**heat-affected zone****HAZ**

that portion of the base metal which has not been melted, but whose mechanical properties or microstructure has been altered by the heat of welding or cutting

3.33**heat****cast lot**

material originating from a final melt

NOTE For remelted alloys, a heat is defined as the raw material originating from a single remelted ingot.

- 3.34**
heat treatment
heat treating
alternate steps of controlled heating and cooling of materials for the purpose of changing physical or mechanical properties
- 3.35**
heat treatment load
that material moved as a batch through one heat treatment cycle
- 3.36**
hot-work, verb
deform metal plastically at a temperature above the recrystallization temperature
- 3.37**
hub
protruding rim with an external angled shoulder and a sealing mechanism used to join pressure-containing equipment
- 3.38**
hydraulic connector
hydraulically actuated drill-through equipment that locks and seals on end connections
- 3.39**
indication
visual sign of cracks, pits or other abnormalities found during liquid penetrant and magnetic particle examinations
- 3.40**
integral, adj
<parts> joined by the forging, casting or welding process
- 3.41**
job-lot traceability
ability for parts to be traced as originating from a job lot which identifies the included heat(s)
- 3.42**
leakage
visible passage of pressurized fluid from the inside to the outside of the pressure-containment area of the equipment being tested
- 3.43**
linear indication
<liquid penetrant or magnetic particle examination> indication whose length is equal to or greater than three times its width
- 3.44**
loose connection
flange (studded or open-face), hub connection or **other end connection** (3.47) used to join together equipment, but not integral to the equipment
- 3.45**
major repair weld
weld whose depth is greater than 25 % of the original wall thickness or 25 mm, whichever is less
- 3.46**
non-pressure-containing weld
weld whose failure will not reduce the pressure-containing integrity of the component

3.47
other end connection
OEC

connection which is not specified in an ISO standard

NOTE This includes ISO flanges and hubs with non-ISO gasket preparations and manufacturer's proprietary connections.

3.48
part
 individual piece used in the assembly of a single unit of equipment

3.49
pipe ram
 closing and sealing component in a ram blowout preventer that seals around tubulars in the wellbore

3.50
post-weld heat treatment
PWHT
 any heat treatment subsequent to welding, including stress relief

3.51
pressure-containing part
pressure-containing member
 part exposed to wellbore fluids whose failure to function as intended would result in a release of wellbore fluid to the environment

EXAMPLES Bodies, bonnets and connecting rods.

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3.52
pressure-containing weld
 weld whose failure will reduce the pressure-containing integrity of the component

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3.53
pressure-controlling part
pressure-controlling member
 part intended to control or regulate the movement of wellbore fluids

EXAMPLES Packing elements, rams, replaceable seats within a pressure-containing member or part.

3.54
pressure end load
 axial load resulting from internal pressure applied to the area defined by the maximum seal diameter

3.55
pressure-retaining part
pressure-retaining member
 part not exposed to wellbore fluids whose failure to function as intended will result in a release of wellbore fluid to the environment

EXAMPLES Closure bolts and clamps.

3.56
product family
 model or type of specific equipment listed in clause 1 of this International Standard

3.57
qualified personnel
 individual with characteristics or abilities gained through training, experience or both, as measured against the manufacturer's established requirements